Plant community development after twelve growing seasons in two experimental wetland basins

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Introduction

We have been monitoring plant cover and species richness in the two experimental basins at the Olentangy River Wetland Research Park (ORWRP) since 1994. In May 1994, Wetland 1 was planted with 2,400 individuals of 13 species of native wetland plants, while Wetland 2 was left unplanted as a control. The hypothesis regarding these basins was that "planted and unplanted basins will be similar in function in the beginning, diverge in function during the middle years and ultimately converge in structure and function" (Mitsch et al., 1998).

This paper presents interpretation of aerial photography of the two experimental wetlands at the ORWRP taken on July 9, 2005, the end of the eleventh growing season for these basins. The previous eleven years are summarized by Mitsch et al. (2005). Our objective was to determine the spatial patterns of plant community development within the two wetlands, and to determine changes in these communities over previous years.

Methods

A color aerial photograph taken by ODOT in July 8, 2005 (Figure 1) was used to outline the wetland area and dominant vegetation communities for 2005. The photograph was scanned and imported into ArcView 3.2. A number of polygons were digitized according to the plant communities. We used ArcView 3.2 for spatial analysis, and those polygons were exported to raster (gridscale)

Figure 1. Color aerial photograph of the two experimental wetland basins, Wetland 1 (W1) and Wetland 2 (W2), taken July 8, 2005.

files in order to compute percentage of area occupied by each vegetation community. Maps were ground-truthed by vegetation surveys made from the wetland boardwalks (see following chapter, this report).

Results and Discussion

Wetland 1 (W1) had approximately 66% macrophyte cover, and Wetland 2 had an estimated macrophyte cover of 39% in July 2005 (Tables 1 and 2; Figure 2). These values were slightly lower than 67% for W1 and 42% for W2, respectively in 2004 for a pulsing hydrology year. This decrease is probably due to the spring non-pulsing conditions causing an overall higher water depth throughout the wetlands.

Figure 3 illustrates dominant vegation community patterns from 1994 - 2005. The overall pattern of vegetation can be summarized in four distinct periods of 3 years' duration:

Initial Convergence, 1994-96

W1 was planted in 1994 and as a result, a distinct pattern of vegetation development around the edge of the wetland was observed in 1995, while the "unplanted" W2 remained relatively free of macrophytes except for an edge zone of cottonwood trees that began to develop on the interior mudflat. By the third year (1996), *Schoenoplectus tabernaemontani* had made its way to the unplanted wetland, and by the end of the 1996 growing season, it appeared that the planted and unplanted wetlands had converged, with *Schoenoplectus* dominating plant cover.

Typha Takes Over, 1997-99

Typha dominance increased dramatically in W2 beginning in 1996 while it has generally comprised less than 17% of the emergent vegetation in W1. By 1999, W2 was totally dominated by a very productive cover of *Typha,*

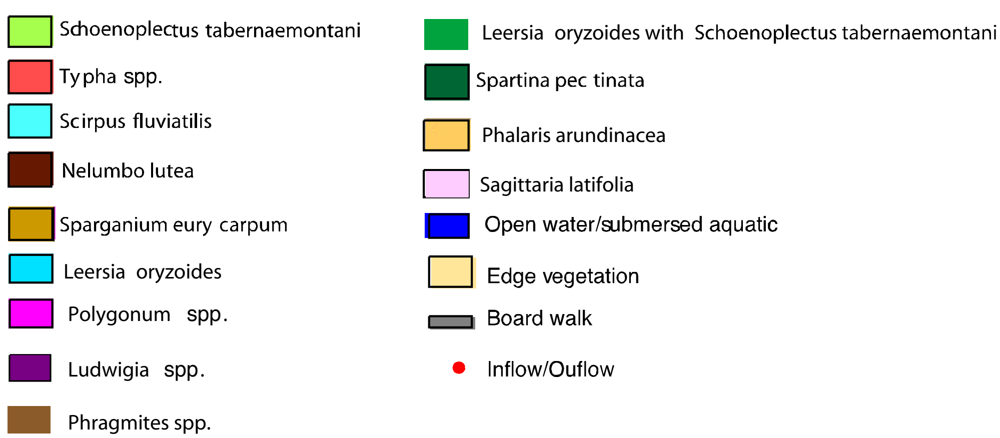
Table 1. Total coverage (m^2) in each experimental wetland of each dominant macrophyte species in 2005.

Communitiy	W1	W2
Emergent Vegetation Community		
Schoenoplectus tab.	326	1693
Sparganium eurycarpum	3401	0
Typha sp.	859	1596
Leersia oryzoides	256	0
Leersia/Schoenoplectus	*1018*	*0*
Phragmites australis	0	48
Scirpus fluviatilis	38	
Total Vegetation	5897	3336
Open Water	3006	5336
Total	**8903**	**8672**

while W1 contained a diversity of communities dominated by four species: *Sparganium eurycarpum*, *Schoenoplectus tabernaemontani*, *Typha spp*. and *Scirpus fluviatalis*.

Wetland Eatout and Resurrection, 2000-2002

Wetland vegetation began to significantly erode in coverage in 2000, and by 2001 W1 and W2 had only 27.6 and 17.4% macrophyte coverage, respectively. The vegetation loss was caused primarily by muskrat activity (Higgins, 2002) and possibly by sediment buildup in the outflow swale that caused water depth to increase over the years. That is one of the reasons a significant drawdown of both basins was conducted in spring and early summer 2002—to allow the seedbank to reset. This approach was successful. At the end of the 2002 growing season, vegetation coverage was the hightest it had ever been (73-74% cover), and *Typha* coverage was only 9% of the total area of W2 and



Legend key for Figures 2 and 3 in this chapter.

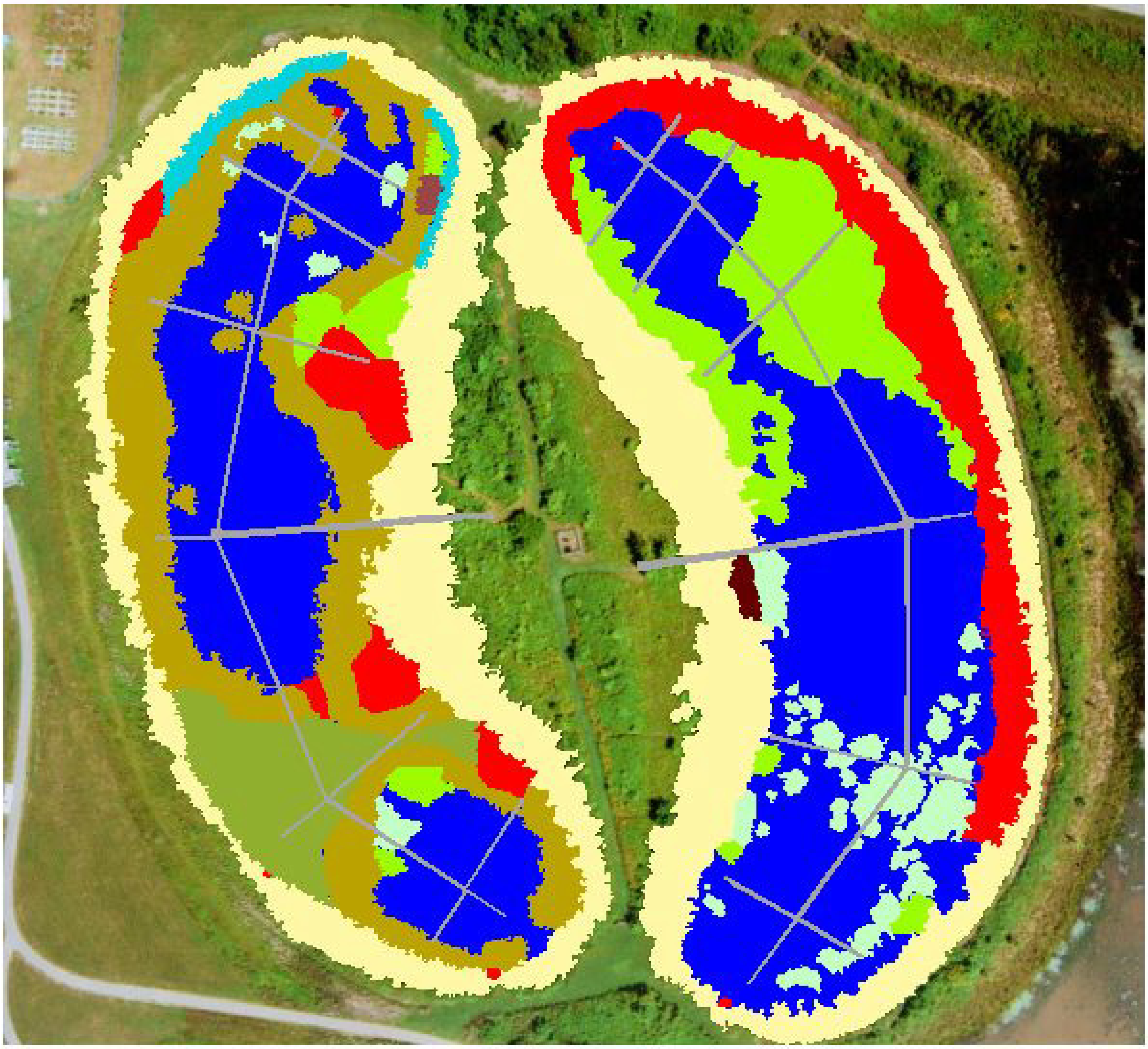


Figure 2. Vegetation map of the experimental wetlands from July 9, 2005 aerial photograph, indicating areas of dominant macrophyte species and open water. See legend on previous page.

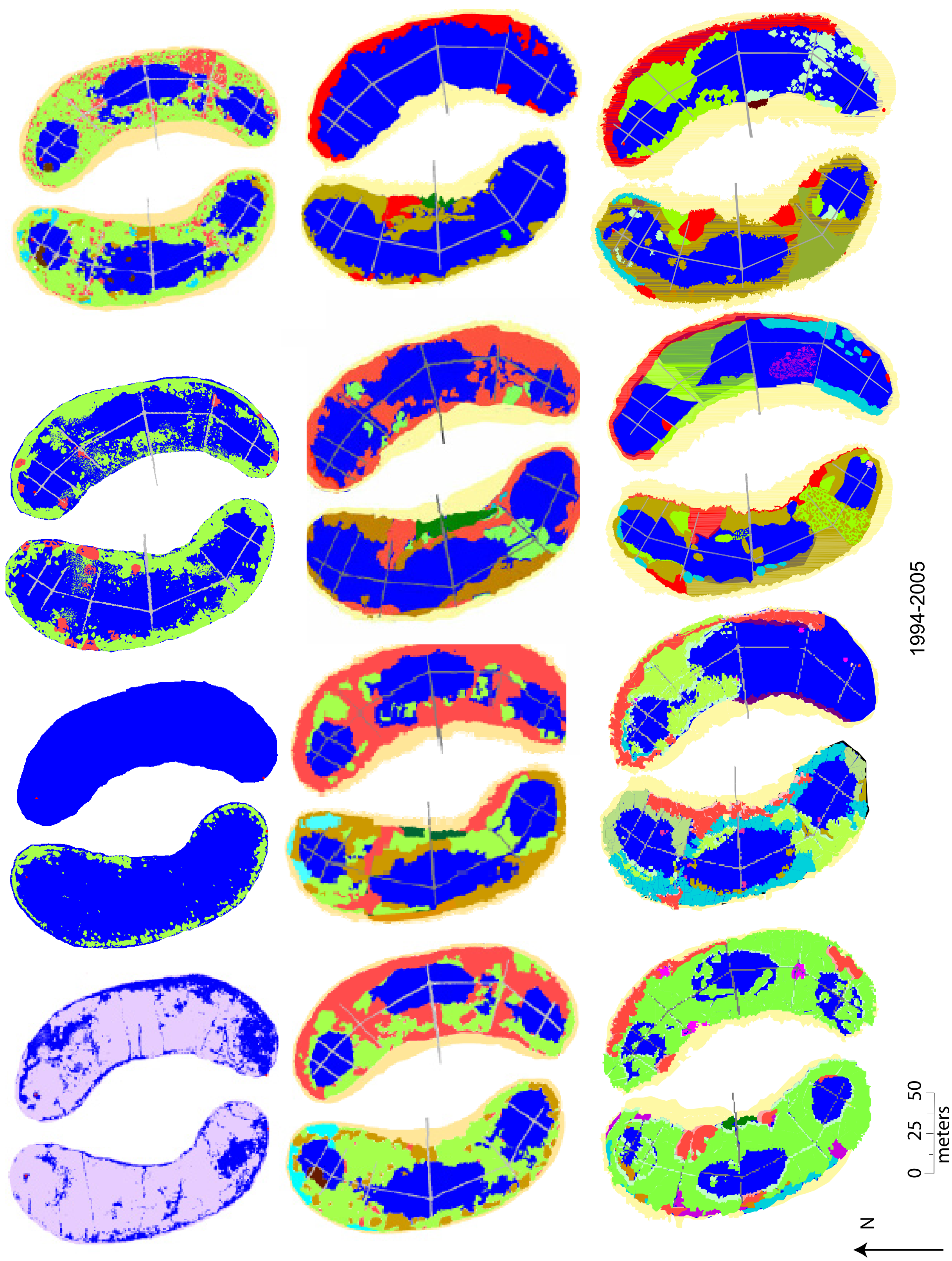


Figure 3. Vegetation communities in pair of experimental wetland from 1994 (upper left) to 2005 (lower right). Legend is two pages previous.

Table 2. Dominant vegetation community patterns from 1994-2005 in experimental Wetlands 1 and 2 (W1 and W2)

Zones that are dominated by	1994		1995		1996		1997		1998		1999	
(%)	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2
Open water	16.3	29.6	87.0	100.0	59.9	63.4	40.2	35.0	39.2	29.6	36.8	33.8
Algal mat	83.7	70.4										
Schoenoplectus tabernaemontani			13.0		36.0	34.8	46.6	48.0	41.2	26.9	21.5	10.1
Typha spp.					4.1	1.9	5.0	16.6	1.1	43.5	8.9	56.3
Scirpus fluviatilis						2.3		4.4		2.9		
Nelumbo lutea							1.2	0.4	1.0			
Sparganium eurycarpum							4.7		13.1		25.4	
Sagittaria latifolia						0.1						
Spartina pectinata											4.5	
Phalaris arundinacea												
Polygonum spp.												
Leersia oryzoides												
Leersia oryzoides with *Schoenoplectus*												
Ludwigra												

Zone that are dominated by	2000		2001		2002		2003		2004		2005	
(%)	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2
Open water	54.3	51.4	72.4	82.7	27.0	26.0	66.4	31.6	33.0	58.2	32.2	61.5
Algal mat												
Schoenoplectus tabernaemontani	8.7	3.4	0.3		52.0	63.0	11.8	20.9	15.9	20.8	3.7	19.5
Typha spp.	16.6	45.2	3.7	17.3	5.0	9.0	7.7	11.6	10.2	11.3	9.7	18.4
Scirpus fluviatilis	0.2									0.4		
Nelumbo lutea												
Sparganium eurycarpum	15.8		21.7		3.0		5.3		38.5		38.2	
Sagittaria latifolia								0.2				
Spartina pectinata	4.2		1.8		1.0							
Phalaris arundinacea	0.2											
Polygonum spp.					6.0	2.0	1.2	0.2		2.4		
Leersia oryzoides					6.0		25.5	4.1	2.3	7.3	2.9	
Leersia oryzoides with *Schoenoplectus*							10.8				11.4	
Ludwigia								0.8				
Phragmiles australis												0.5

5% of the total area of the originally planted W1. This was a considerable reduction from 1999, the peak year, when *Typha* occupied 56% of the cover in W2. One of the most significant changes in 2002 was the increased coverage by *Schoenoplectus tabernaemontani* in both wetlands, apparently due to regeneration from the marsh seedbank. *Schoenoplectus tabernaemontani* (a.k.a. *Scirpus validus*) dominanace increased in both basins in 2002—from 0.3 to 52% coverage in W1 and from 0 to 63% in W2.

Pulsing Experiment, 2003-2005

We continued a pulsing experiment begun in 2003 in the experimental wetlands (see hydrology chapter), when several multi-day floods were pulsed through the wetlands, mostly in late winter and spring. This pulsing was one of the reasons for the shift in the pattern of dominant vegetation communities in the two experimental wetlands. The spring pulses appear to have led to a reduction in macrophyte cover in the wetland basins.

One of the new "communities" that developed in W1 in 2003 (*Schoenoplectus tabernaemontani-Leersia oryzoides*) was identified in 2004 as two separate communities (*Schoenoplectus tabernaemontani* and *Leersia oryzoides)* but was again identified as a combined community in 2005. *Polygonum* spp. cover, which was 6 and 2 % respectively in W1 and W2 in 2002, attained only 0 and 2% coverage in 2004, and was not found in the wetlands in 2005. In March 2005 we started a comparison of the previous years' pulsing with stready-flow conditions (see hydrology chapter). It was hypothesized that lact of spring pulses might lead to a reduction in macrophyte cover and diersity in the wetland basins. *Sparganium eurycarpum* continued to dominate W1 with a cover of 38% in 2005, similar to the 38% coverage in 2004. *Schoenoplectus tabernaemontani* declined in 2005 to 4% cover from a pulsing year cover of 16%. Typha coverage in 2005, at 10%, was similar to coveage in pulsing year 2004.

Coverage for *Typha* increased in W2 from 11 to 18% from 2004 to 2005 while *Schoenoplectus tabernaemontani* cover remained similar in both years (21 and 20% cover respectively in 2004 and 2005) in W2. One of the new communities that developed in W2 in 2005 is *Phragmiles* spp. whic now has 0.5% cover adjacent to the main boardwalk entrance (Table 1). We did not take coverage into account for *Potamogeton* spp. for both basins, although this community appeared at both basins.

Overall, the removal of pulses appeared to favor a reduction in bulrush (*S. tabernaemontani*) and a slight increase in *Typha*. Overall plant cover changed very little.

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